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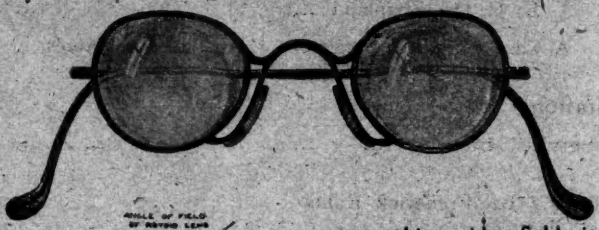

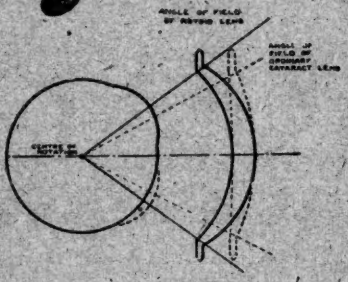

seen this wide field is obtained by having the posterior surface of the lens to correspond with the rotation of the eye.

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THE BRITISH JOURNAL

OF

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APRIL, 1944

COMMUNICATIONS

PRINCIPLES OF RETINOSCOPY

presented on the basis of the theory of projection

BY

M. KLEIN*

LONDON

RETINOSCOPY is the achievement of the latter part of the 19th century, the century of physics, and almost all the significant theoretical work had been published by about 1906. Among the few more recent authorities who have contributed to the problem, Marquez and Polliot are to be mentioned. Tribute has to be paid to Borschke (1904) whose name is almost entirely forgotten. He was the first to point out that the basis of retinoscopy is the same as that of any projection, a line taken up recently by Polliot.

Landolt's presentation, which is best known, is based on two assumptions that during examination the observer sees the patient's pupil, and the image of the retinoscopic light-source on the patient's retina. The construction therefore is based on these two elements, and illustrations of this kind are used in many text-books. Another explanation frequently used in text-books is based on the relation between the retinoscopic visual field, and the projection of the immediate source of light upon the plane of the punctum remotum. It may be difficult for a student with a limited

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knowledge of physics to understand these explanations although they are correct from a physical point of view. The problem can be presented in a way which may be more easily understood.

The following presentation is based on the theory of projection. For the sake of completeness elementary considerations had to be included.

A *simple optical system* is composed of three elements: Light-source, aperture, and screen. (Fig. 1). The source emits light-rays in all directions, and illuminates the screen. An aperture is a hole made in an opaque sheet, or body. If we place the aperture between light and screen, only the light passing through the aperture can reach the screen. If the source is far from the aperture, the light-patch on the screen resembles the form of the aperture, if it be round, the light-patch will also be round, if it be square,

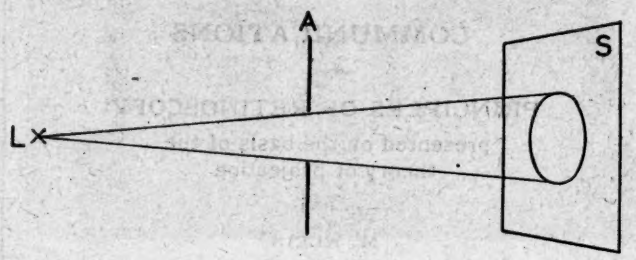

FIG. 1.

L light-source. A aperture. S screen.

the light-patch will be square. The light-patch is surrounded by shadow, which is the shadow of the opaque rim of the aperture. If we move the source of light upward, the light-patch on the screen will move down. The light passing through the aperture is called a light-pencil or beam, and the size of the aperture exerts an influence on the light-pencil by limiting its size. If the light-source is far from the aperture, the illuminated area on the screen is small, and as the source comes nearer, the light-patch gets larger. Eventually if it is situated in the aperture the whole of the screen is lit up.

Effect of mirrors and lenses:—If now we place mirrors or lenses in the way of the light; the mirrors alter the direction, and the lenses alter the vergence of the light. Besides these effects, the lenses and mirrors themselves have the effect of an aperture also. The edge of the mirror or lens limits the reflected or refracted light-pencil (aperture effect). The optical surfaces give an image not only of the light-source, but also of the apertures and the screen (Fig. 2). (When a driver looks into the side mirror of his

motor-car and sees in it the driver of the car behind him, the latter can see the driver of the first car in the same mirror).

Conjugate focus:—If a convex lens is introduced into this simple system the divergent rays, falling on to the lens, will be refracted and transformed into a convergent light-pencil. The convergence

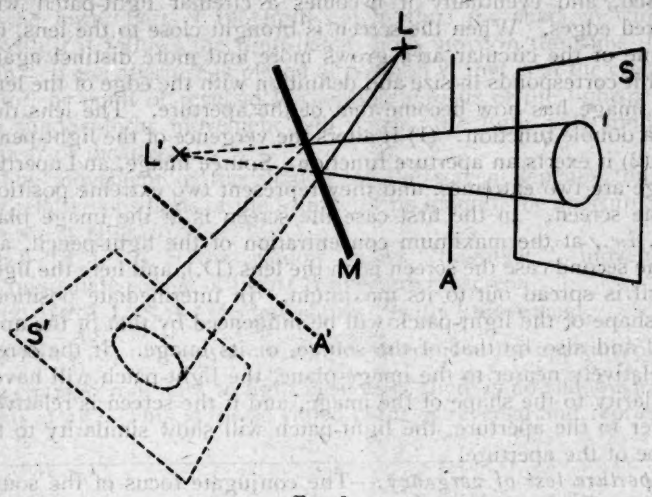

FIG. 2.

Mirror (M) gives an image of the light-source (L'), of the aperture (A') and screen (S').

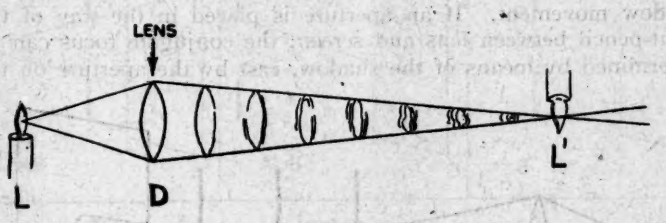

FIG. 3.

of the refracted light-pencil can be shown by moving the screen to and fro. If the screen is placed at the apex of this convergent light-pencil, an inverted image of the light-source is formed. The degree of vergence of the refracted light-pencil depends on two factors:—1. The distance of the source from the lens, and 2, the dioptric power of the lens. The position of the image is, therefore, determined by the refractive power of the lens, and its distance from the source. For a certain lens, and source at a

certain distance, only one image-distance exists. They thus have three interdependent numerical values, and image and source are called conjugate foci.

If the screen is moved towards the lens the image becomes blurred, but it is still similar to the source. If now the screen is moved still nearer to the lens, the image becomes more and more blurred, and eventually it becomes a circular light-patch with blurred edges. When the screen is brought close to the lens, the outline of the circular area grows more and more distinct again, until it corresponds in size and definition with the edge of the lens. The image has now become that of the aperture. The lens thus has a double function. (1) It alters the vergence of the light-pencil and (2) it exerts an aperture function. Source image, and aperture image are two extremes, and they represent two extreme positions of the screen. In the first case the screen is at the image plane (L'), *i.e.*, at the maximum concentration of the light-pencil, and in the second case the screen is on the lens (D.), and here the light-pencil is spread out to its maximum. In intermediate positions, the shape of the light-patch will be influenced by that of the aperture, and also by that of the source, or its image. If the screen is relatively nearer to the image-plane, the light-patch will have a similarity to the shape of the image, and if the screen is relatively nearer to the aperture, the light-patch will show similarity to the shape of the aperture.

Aperture test of vergency:—The conjugate focus of the source has been so far determined by means of its image. There exists, however, another method, and that is, by the use of an aperture, and may be called the aperture test of vergence by means of shadow movement. If an aperture is placed in the way of the light-pencil between lens and screen, the conjugate focus can be determined by means of the shadow, cast by the aperture on the

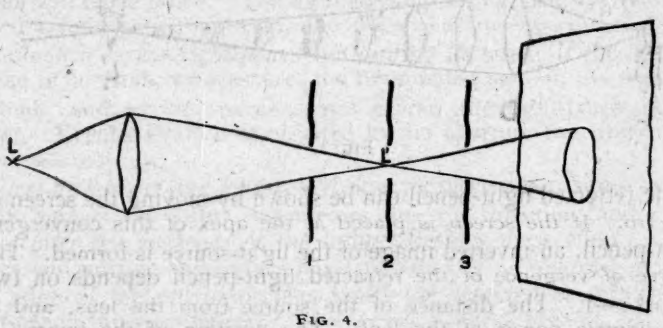

FIG. 4.

Aperture in different positions (1, 2, 3) in relation to the image-plane L', L—light-source, L' image of light source, S—screen.

screen. If the aperture is at position 3 (Fig. 4) when the light-patch is moved upward, the aperture rim cuts off the upper part of the light-pencil thus causing an "against" shadow. The shadow comes against the direction of the movement of the light-patch. But in position 1, when the light-patch moves upward, the aperture rim cuts off that part of the light-pencil which goes to the lower part of the light patch, thus the shadow will be "with," it follows the light-patch, both move in the same direction. If the aperture is placed at position 2, that is at the crossing point, or point of reversal, or conjugate focus of the light-pencil, no shadow-light movement will ensue, the light will suddenly appear or disappear.

The movement of the shadow on the screen depends thus on the relative positions of the source (or its image), the aperture, and the screen (Fig. 5).

(1) In L' A S the shadow shows "against" movement. L' immediate source of light; A aperture; S screen.

(2) In A L' S the shadow shows "with" movement.

(3) In $\frac{A}{L'}$ S, that is when the light-source is in the aperture plane, the change from dark to light is sudden, there is no shadow movement at all. This is the so called point of reversal and represents

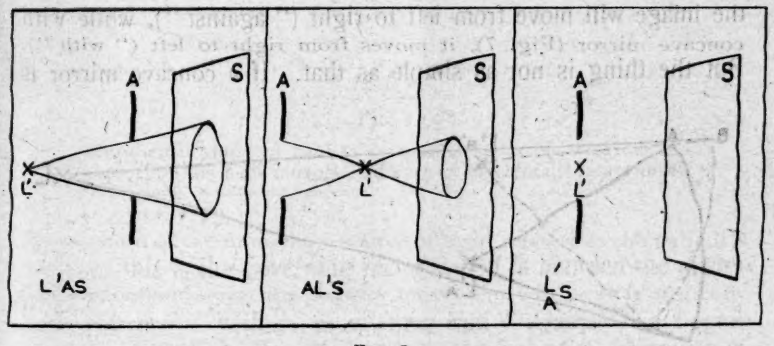

FIG. 5.

L', immediate source of light, A aperture, S screen.

the conjugate focus of the source and plays an important part in retinoscopy.

Retinoscopic mirrors:—In retinoscopy the light is projected into the patient's eye by means of mirrors. The explanation usually given is, that with the plane mirror, Fig. 6, the image of the light-source (immediate source of light) L', is behind the mirror, whereas with the concave mirror it is in front of the mirror. Thus

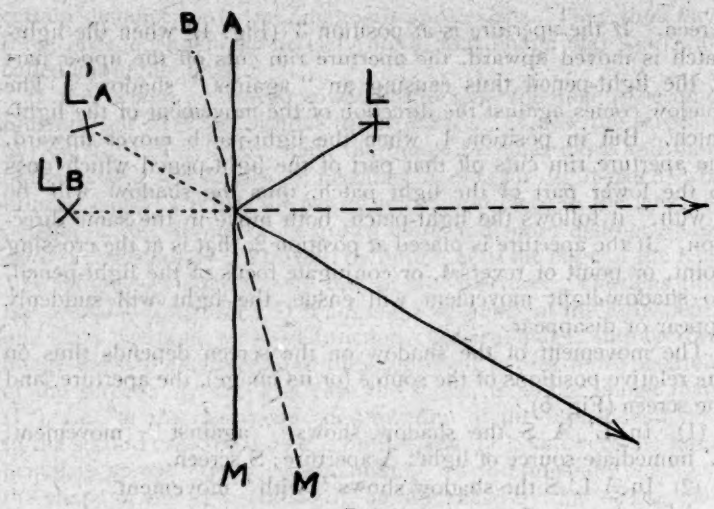

FIG. 6.

Plane mirror is turned toward left (from A to B), the image L' will move toward right from L'A to L'B.

if we turn the mirror from right to left in case of a plane mirror the image will move from left to right (" against "), while with concave mirror (Fig. 7), it moves from right to left (" with "). But the thing is not as simple as that. If a concave mirror is

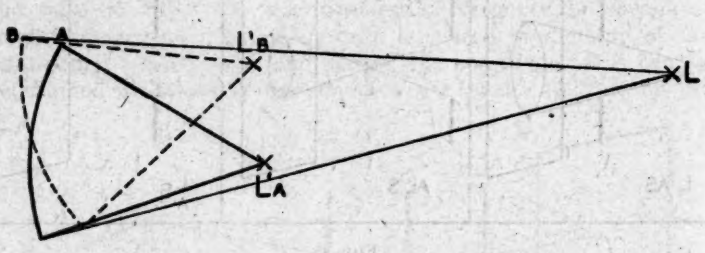

FIG. 7.

Concave mirror turned toward left (from A to B) image of light-source will move toward left (from L'A to L'B).

used with a convergence power of *e.g.*, 4 D. and the lamp is at about 1 metre, the image of the lamp is formed about 30—35cm. from the mirror. Now, if the curvature of the mirror is reduced, the image of the source will move further away from the mirror, that is, the convergence of the reflected rays

is reduced (Fig. 8). And when the curvature is such, that the source is in its focus, the rays will have a vergency of zero, that is a beam of parallel rays will emerge (Fig. 8, F), and if the convergence power of the mirror is still further reduced the reflected rays will become divergent (Fig. 8, G).

In retinoscopy the observed shadow-light movement depends not on whether plane or concave mirror is used, nor whether the immediate source of light is in front of or behind the mirror, but upon

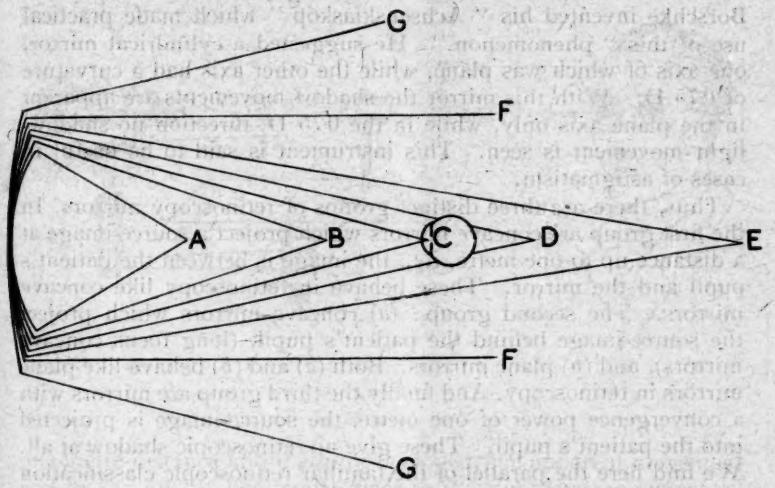

FIG. 8.

The original source of light is assumed to be at the fixed distance (approx. 1m. from the mirror). Mirrors of different curvature reflect light-pencils of different vergence.

the position of the immediate source of light relative to the patient's eye, and this is the governing factor. If it is between the mirror and the patient's eye, the shadow movement will be that of a concave mirror, "with" in myopia, and "against" in hypermetropia (Fig. 8 A, B). If, however, the image of the source is behind the patient's eye, the shadow movement will be that of the plane mirror, "against" in myopia, and "with" in hypermetropia (Fig. 8. D—G). In the case, *e.g.*,, of a concave mirror with such a convergence power that the image will be formed about 2 metres from the mirror, *i.e.*, one metre behind the patient's eye, then although this image will move in the same direction as the mirror, yet the observed retinoscopic shadow-light movement will be that of a plane mirror. The third possibility is that the immediate source of light falls in the pupil (Fig. 8, C), in this case

no shadow-light movement will be observed at all, whatever refraction the patient's eye may have. The explanation is similar to that which applies to Fig. 5, case (3) $\frac{A}{L}$, S. This point is a point of reversal, and Marquez called it " the first neutral point," but before him it was already known that with a concave mirror which reflects a convergent light-pencil, the apex of which falls on the patient's pupil no shadow movement can be observed. (Van den Bergh, 1894), and in 1904 Borschke invented his " Achsenskiaskop " which made practical use of this " phenomenon." He suggested a cylindrical mirror, one axis of which was plane, while the other axis had a curvature of 0·75 D. With this mirror the shadow movements are apparent in the plane axis only, while in the 0·75 D. direction no shadow-light movement is seen. This instrument is said to be useful in cases of astigmatism.

Thus, there are three distinct groups of retinoscopy mirrors. In the first group are concave mirrors which project a source-image at a distance up to one metre, *i.e.*, the image is between the patient's pupil and the mirror. These behave in retinoscopy like concave mirrors. The second group: (*a*) concave mirrors which project the source-image behind the patient's pupil, (long focus concave mirrors), and (*b*) plane mirrors. Both (*a*) and (*b*) behave like plane mirrors in retinoscopy. And finally the third group are mirrors with a convergence power of one metre, the source-image is projected into the patient's pupil. These give no retinoscopic shadow at all. We find here the parallel of the familiar retinoscopic classification of the three groups of eyes: (1) myopia greater than one D., (2) myopia of less than one D., emmetropia, and hypermetropia, and (3) myopia of 1 D. which marks the point of reversal.

Aim of retinoscopy, determination of the vergence of the emitted light-pencil:—As it was shown previously, if the distances of the two conjugate foci are known, the refractive power of the lens can be calculated. In retinoscopy the problem is different, because the question is: the position of the retina relative to the refractive system of the eye, whether the retina is in focus or not, or expressed in other terms, what is the vergence of the light-pencil emerging from the patient's eye when the eye is at rest. The emerging light-pencil may be convergent in myopia, it may be parallel in emmetropia, and finally it may be divergent in hypermetropia.

Model experiment to retinoscopy: An experiment in which the conditions are made as simple as possible is the following. A small tubular box is fitted with a 40 D. convex lens at one end, and the other end of the box is made of tracing paper. Some

arrangement is made to move the lens nearer and farther away from the tracing paper. Here we have a model eye, the lens being its refractive system, while the tracing paper is its retina. Now, if a narrow beam of light falls on the tracing paper, for instance from the slit-lamp, there is an illuminated area on the retina of the model (Fig. 9), and by adjusting the distance between lens and tracing paper the model can be made myopic, hypermetropic or emmetropic (or by a clip-on cylindrical lens, astigmatic). If the model is set for hypermetropia, and the observer looks into it from

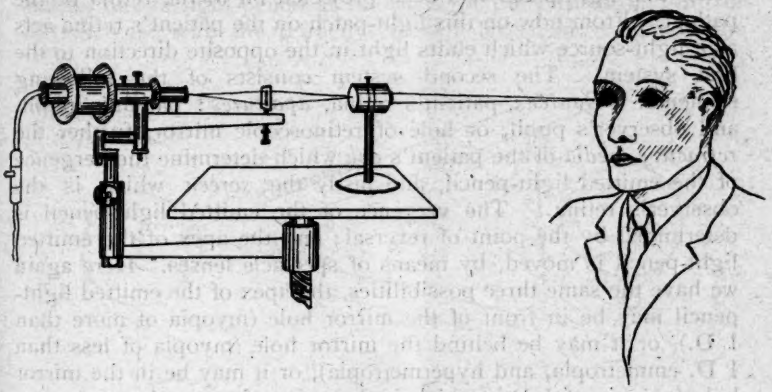

FIG. 9.

one metre distance and the light is moved, the apparent movement will be "with." The model gives in this simple arrangement all the elements of retinoscopy: *source* (the light-patch on the retinal portion of the model), *refractive system* which determines the vergence of the emitted light-pencil, and the *observer's eye* which contains two essential elements, the *pupil* which is the aperture, and the *observer's retina* which is the screen. The apex of the convergent beam (point of reversal) is the image of the light-patch on the model's retina, and here again there are the same elements, and the same possibilities. It may be (as in Fig. 5) light-aperture-screen (L' A S), or aperture-light-screen (A L' S), and light in the aperture $\binom{L'}{A}\ S)$ which is the point of reversal. If the observer is at one metre distance from the model, and the emerging light-pencil has a vergence greater, or less than that distance, by inserting concave lenses the vergence can be reduced, and by convex lenses it can be increased, *i.e.*, by means of spectacle lenses the apex of the length-pencil can be moved. In this experiment—as in practical retinoscopy—the observer's pupil, and retina are essential.

In *clinical retinoscopy* the conditions are somewhat complicated as there are two systems. The first system creates a light-patch which is caused to move on the patient's retina. This is done by reflecting the light of a lamp into the patient's eye by means of a mirror. In this system the elements are: *immediate source of light* which is the image of the lamp formed by the retinoscopic mirror, *apertures*: the edge of the mirror and the pupil of the patient, and the *screen* on which the light-patch is formed, which is the retina of the patient. The task of this first system is fulfilled when this light-patch has been projected on to the retina of the patient. From now on this light-patch on the patient's retina acts as a light-source which emits light in the opposite direction to the first system. The second system consists of the following elements. *Source*: patient's retina, *apertures*: patient's pupil, and observer's pupil, or hole of retinoscopic mirror, further the *refractive media* of the patient's eye which determine the vergence of the emitted light-pencil, and lastly the *screen* which is the observer's retina. The vergence of the emitted light-pencil is determined by the point of reversal; and the apex of the emitted light-pencil is moved, by means of spectacle lenses. Here again we have the same three possibilities, the apex of the emitted light-pencil may be in front of the mirror hole (myopia of more than 1 D.), or it may be behind the mirror hole (myopia of less than 1 D. emmetropia, and hypermetropia), or it may be in the mirror hole (myopia of 1 D.), which is the point of reversal.

This presentation takes into consideration *only* the emergent light-pencil, and by it the retinoscopic phenomena are explained in the space *in front* of the eye. This is justified as the law of the conjugate foci is valid not only for source and image, but also for the whole light-pencil, and the emerging light-pencil is conjugate with that inside the eye. By determining the one, the other is computed. There are only two points of elementary physics with which the student has to be familiar: (1) image formation through lenses, (2) the aperture test of vergence by means of which it is possible to determine the point of reversal of a light-pencil.

The material hitherto presented is sufficient for understanding the principles of retinoscopy. There are, however, some details which have practical importance, and these need further consideration.

1. *Retinoscopic field* is the area on the patient's retina which is covered by the light-pencil corresponding to the mirror-hole or observer's pupil. In this presentation the retinoscopic field can be dispensed with and the mirror-hole itself substituted for it.

2. *The speed of the reflex-movement.* In fixed distance retinoscopy the factors governing the real movement of the immediate source of light, such as the distance of the retinoscopic lamp from

the observer, and the distance between patient and observer can be regarded as constant, and only the refraction of the patient's eye has to be taken into account.

The emerging light-pencil is in hypermetropia divergent, in myopia convergent, but beyond the point of reversal it will become divergent again. With the increase of the refractive error the convergence of the myopic, and the divergence of the hypermetropic emitted light-pencil increases. The observer is thus placed in the light-pencil itself (Fig. 10), and the area of the cross-section of the light-pencil at the plane of the retinoscopic mirror will increase with the refractive error. Every movement of the

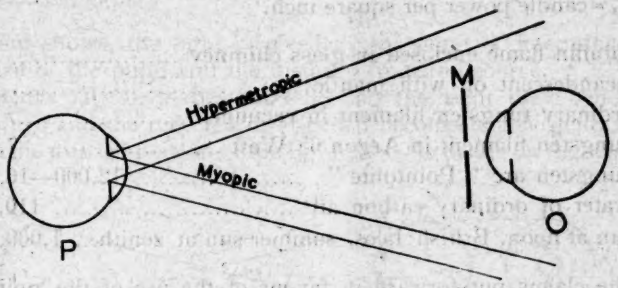

FIG. 10.

The observer's eye (O) is situated in the light-pencil emitted from the patient's eye (P).

mirror will move the whole light-pencil, and if this cross-section is large, *e.g.*, in higher refractive errors, it will take some time for all the rays to pass the mirror hole, and it will be perceived as slow. When spectacle lenses are placed before the eye, and the refractive error is reduced the cross-section of the light-pencil at the plane of the retinoscopic mirror becomes smaller and smaller. Here a very small movement of the mirror will be sufficient for the light-pencil to pass over the mirror-hole, and it will be perceived as fast. Eventually the point of reversal is reached, the apex of the light-pencil is at the plane of the retinoscopic mirror, and the slightest movement will produce a sudden change in the illumination from light to dark.

Borschke made a practical suggestion for estimating the refraction by the area of the reflection of his square mirror. This will be described later in " retinoscopy in astigmatism."

(3). *Brightness of the pupillary light* depends upon the brightness of the retinal light-patch, and upon the refraction of the examined eye: The factors determining these are: (*a*) brightness

of the light-source, (*b*) distances, (*c*) apertures and (*d*) losses in transmission.

(*a*) *Brightness of the light-source,* not the candle power alone but also its relation to the area of the incandescent element has to be considered. This will determine the brightness of the light-patch projected on to the patient's retina. If the intrinsic brightness of the incandescent element be increased, the intensity of the light-patch will increase. For instance of two bulbs with the same candle power, the one in which the area of the incandescent element is smaller and therefore its intrinsic brightness greater, will give a brighter light-patch.

Some examples of intrinsic brightness are:—*Intrinsic brightness,* = candle power per square inch.

Paraffin flame enclosed in glass chimney	10
Incandescent oil with mantle	340
Ordinary tungsten filament in vacuum	960
Tungsten filament in Argon 65 Watt	7,500
Tungsten arc " Pointolite "	12,000—16,000
Crater of ordinary carbon arc	110,000
Sun at noon, British Isles, summer sun at zenith	1,000,000

The claims put forward in favour of the use of the pointolite lamp are supported by these figures.

In retinoscopy the light-patch on the patient's retina is the source. If all other factors remain unchanged, the intrinsic brightness of the light-patch will be at maximum when its area is smallest, that is when it is a sharp image of the source.

(*b*) *Distances:*—the general rule, that the brightness of the light-patch decreases as the square of the distance holds true in retinoscopy. With a plane mirror the rule is simple, the nearer the source is to the mirror, the better the light-output. With a concave mirror, however, the position is different, as it has a combined action of reflecting and bending the light, *i.e.*, it alters the direction as well as the vergence of the reflected light-pencil.

(*c*) The *apertures* are: edge of the mirror, patient's pupil, mirror hole (or examiner's pupil).

Mirrors: assuming that the light-source and distances (of the patient and of the light-source from the mirror) remain unaltered, some comparison can be made between plane and concave mirrors.

Plane mirrors limit the size of the reflected light-pencil. The diagram (Fig. 11) shows that the light reaching the pupil is proportional to the area of the cross-section of this light-pencil in the pupillary plane in relation to the area of the pupil. The utilized portion of this light-pencil is not influenced by the mirror, and, as the

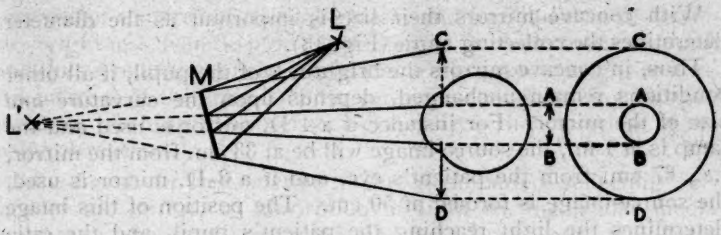

FIG. 11.

The plane-mirror (M) reflects a light-pencil which has diameter CD at the pupillary plane (large circle), and only a fraction of this (small circle) enters the pupil. The utilised portion of the light-pencil is relatively small.

diagram shows, the light received by the pupil is determined by the size of the pupil and the distance from the source.

Concave mirrors:—besides reflecting the light they bend the light-rays and the reflected light-pencil becomes convergent. Here again the utilized portion of the light-pencil depends on the relation

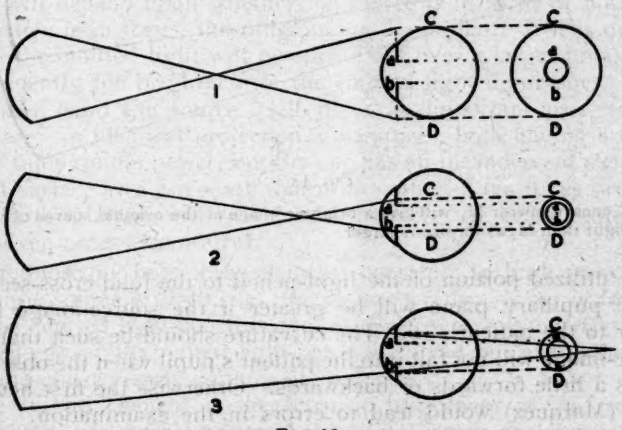

FIG. 12.

Concave mirrors of different focal length. The utilized portion of the light-pencil (which enters the pupil) is better in 2 and 3 than in 1.

between the area of its cross-section at the pupillary plane, and that of the pupil; but the area of the cross-section of the light-pencil depends upon the focal length of the mirror.

Fig. 12 shows concave mirrors with different focal lengths. The utilized portion of the light-pencil will be better in 2 and 3 than in 1.

With concave mirrors their size is important as the diameter determines the collecting angle (Fig. 13).

Thus, in concave mirrors the brightness of the pupil, if all other conditions remain unchanged, depends upon the curvature *and* size of the mirror. For instance if a 4 D. mirror is used and the lamp is at 1 m., the source-image will be at 33 cm. from the mirror, *i.e.*, 67 cm. from the patient's eye, and if a 3 D. mirror is used, the source-image is formed at 50 cm. The position of this image determines the light reaching the patient's pupil, and the ratio

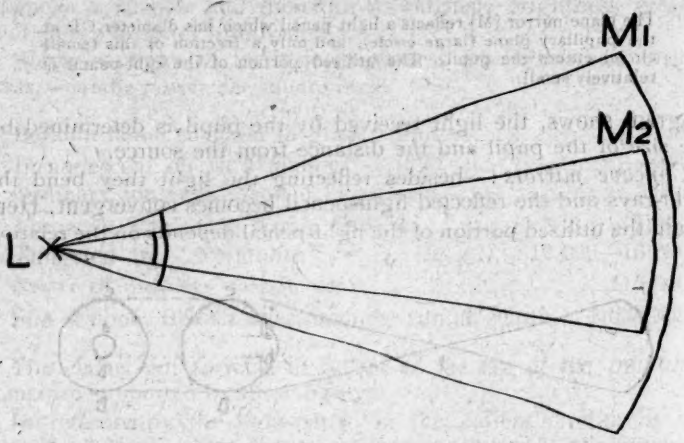

FIG. 13.

Concave mirror M_1 will give a brighter image of the original source of light than M_2 as its size is larger.

of the utilized portion of the light-pencil to the total cross-section at the pupillary plane will be greater if the source-image falls nearer to the patient's eye. The curvature should be such that the source-image will not fall into the patient's pupil when the observer moves a little forwards or backwards. Otherwise the first neutral point (Marquez) would lead to errors in the examination.

There is no doubt that a suitable concave mirror gives better illumination than a plane one, and in high refractive errors, when it is almost impossible to see any reflex movement with a plane mirror, it is easily seen with a suitable concave mirror.

The rôle of the size of the patient's pupil and the mirror-hole :— The brightness of the pupillary light will increase with the diameter of the pupil. But the increase of the size of the pupil is accompanied by an increase of the size of the confusion circles, when the retinal image of the light-source is a blurred image (and usually this is the case in retinoscopy). This will lead to an

increase of the area of the light-patch, and consequently its intrinsic brightness (candle-power per square inch) becomes reduced, and thus a reduction of the brightness of the pupillary light ensues. An increase of the size of the mirror-hole—though it may increase the light reaching the observer's eye—affects the sharpness of the point of reversal.

(*d*) *Losses in transmission*:—due to imperfect reflecting surface of the mirror, to absorption of light by the ocular media (normal or abnormal structures), spectacle lenses, etc., to absorption of light by the retina, and its pigment layer, will reduce the brightness of the pupillary light.

The retinoscopic lamp, the mirror, and the apertures determine how much light enters the eye, but to appreciate fully the elements of the brightness of the pupillary light, the examined eye has to be regarded as a projection apparatus, which projects a beam of light towards the observer. Here there are two elements: 1, the proper focusing of the optical system of the apparatus (refraction of the eye), and 2, the brightness of the source (light-patch on retina). In a projection apparatus, the brightness of the emitted light will depend upon whether the source is in focus or not. If the source is in focus, the illumination is optimal. If it is out of focus, the emitted light will be spread out over a larger area, and consequently the brightness of the emitted light diminishes. On the other hand the source itself plays an important part, for if there are two identical projection apparatuses, both having a bulb of the same candle power, but the one has an incandescent element with a surface area one-tenth that of the other, a ten times greater intrinsic brightness will result, and therefore the beam projected will be ten times as powerful.

In retinoscopy both these elements operate. In high refractive errors the source of light, *i.e.*, the patient's retina, is out of focus, and the emitted light-pencil is con- or di-vergent and therefore the light-energy of the retinal light-patch is spread out over a larger area and consequently its intensity reduced.

The second element is the intrinsic brightness of the retinal light-patch. In refractive errors the retinal image of the source is a blurred image which may occupy a considerable area. But as the quantity of light emitted by the retinoscopic lamp remains unchanged the intrinsic brightness of the retinal light-patch will be reduced in proportion to the increase of its area. In retinoscopy the size of the retinal light-patch varies continually with each new spectacle lens put before the patient's eye.

If the brightness of the retinal light-patch were kept constant, the pupillary light would diminish in refractive errors because of the con- or di-vergence of the emitted light-pencil. On the other

hand if the vergence of the emitted light-pencil were kept constant and the brightness of the retinal light-patch varied, the pupillary light would vary proportionately. The poor pupillary light in higher refractive errors may be attributed to the combined effect of these two factors, the reduction of the intrinsic brightness of the retinal light-patch, and the vergence of the emitted light-pencil. They vary during retinoscopy in a way which shows a certain parallelism. With the correction of the refractive error both are improved, but their optima never meet. If the source were in the mirror-hole the maximum brightness of the light-patch and the maximum concentration of the light-pencil would coincide at the point of reversal.

4. *The shadow in retinoscopy*:—According to Landolt the shadow is the edge of the retinal light-patch. It may be recalled that the light-patch is the combined effect of the source and of the aperture (patient's pupil). The shadow is caused by the patient's iris. A clinical experience which supports this is that the retinoscopy of albinotic eyes is difficult, and the explanation may be the absence of pigmentation of the albinotic iris which thus provides a poor shadow.

There seems to be a difference of opinion as regards what should be observed during examination, the movement of shadow, or of the little central bright spot, which as Williamson-Noble pointed out is particularly noticeable using a Pointolite lamp. In any case the observation is based on contrast. The central bright spot can be obtained with any light-source of small area. The small opening of the Lister ophthalmoscopic bulb is quite satisfactory, and it is marked if a concave cylindrical mirror is used for retinoscopy. This central bright spot makes it easy to keep the attention of the examiner at the central part of the pupil.

The *mirror-hole* causes a shadow in the light-pencil when the hole is drilled, and a dimming of the centre only if the silvering has been removed. At the point of reversal mirror and patient's retina are conjugate foci, and the image of the mirror-hole may be the cause of the so-called central grey disc which can be seen at the point of reversal. In a mirror with no hole, as for instance in using a transparent mirror, such as Imre's reflector glasses, the central grey disc is not noticeable.

5. *Factors influencing the point of reversal*:—Hitherto the definition of the point of reversal has been the position in which the image of the source (*i.e.*, that of the retinal light-patch) is situated at the plane of the aperture (mirror-hole or observer's pupil) and is characterized by the sudden appearance or disappearance of the pupillary light, without the examiner being able to see any movement of light or shadow. By moving the mirror the light-patch on the patient's retina is caused to move, and yet the

observer cannot see it. The questions of the point of reversal are: (*a*) Why is it that there is a sudden change of shadow and light at the point of reversal, and (*b*) What happens during retinoscopy in the examiner's eye? (*c*) What are the factors influencing the point of reversal.

(*a*) As is known, the refracted light-pencil has a maximum concentration at the image plane, *i.e.*, the image elements are condensed to the smallest possible area; while before or behind the image plane the image-elements are spread out to form confusion circles. If the aperture lies before or behind the image plane, where the confusion circles have reached a certain size, it is possible for them—by moving the *source-image* to move into the aperture gradually, *i.e.*, it may be that one part of a confusion circle is inside the aperture, while the rest of it is yet outside the aperture, on its opaque rim (Fig. 14). In such a case a gradual

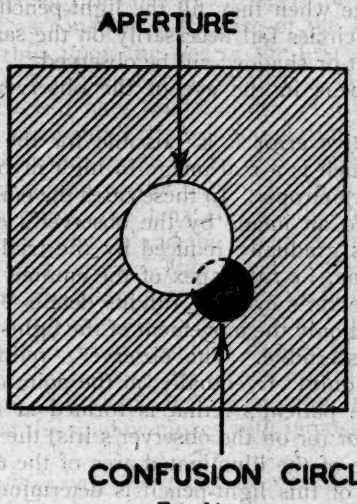

FIG. 14.

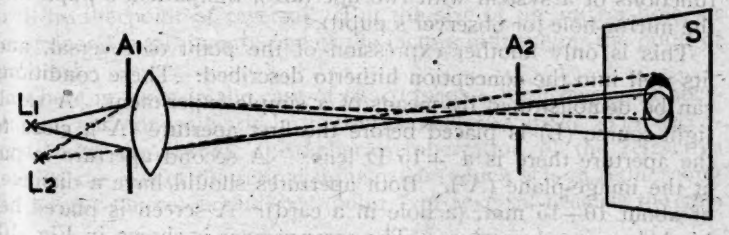

FIG. 15.

increase or decrease of the light-patch on the screen will result, and there will be a noticeable shadow-light movement (Fig. 15).

When the aperture is getting nearer to the image plane, the confusion circles become smaller and smaller, and at the image plane their area is condensed to a maximum, they are so small that when they pass the aperture rim at all, they pass it entirely. At the point of reversal there are two possibilities only: the image element falls either at the opaque rim of the aperture, and in that case no light passes the aperture, and the screen remains in darkness, or the image element falls into the aperture when the screen is suddenly lit up.

The absence of movement may be explained by the following: The image elements, after passing the aperture, travel on until they reach the screen, as confusion circles. The size of the confusion circles will increase with the distance of the screen from the image plane; they overlap each other, and eventually the confusion circles reach a size when they fill the light-pencil. In that stage all the confusion circles fall necessarily on the same area, and no movement of light or shadow will be observed.

(*b*) What happens in the eye of the observer during retinoscopy?

In high refractive error it is possible for the observer to see fundus details which is a real image in high myopia, or a virtual one in high hypermetropia. In these cases the emitted light-pencil can be brought to an image by the observer's eye. But as the refractive error is gradually reduced by the trial lenses, and the image of the retina, *i.e.*, the apex of the emitted light-pencil gets closer to the observer's eye, the fundus details become more and more blurred, and only the movement of the light-patch (the reflex-movement) is discernible. The observer's retina receives large confusion circles only. Eventually, at the point of reversal, when the image of the patient's retina is formed at the plane of the retinoscopic mirror (or on the observer's iris) the confusion circles occupy the whole of the illuminated area of the observer's retina. Now as the size of this light-pencil is determined by the size of the patient's pupil the phenomena of the point of reversal are the functions of a system with two apertures, the patient's pupil and the mirror-hole (or observer's pupil).

This is only another expression of the point of reversal, and fits well into the conception hitherto described: These conditions can be demonstrated by means of a simple experiment. A small light-source (L) is placed before the first aperture (A^1), close to the aperture there is a +15 D lens. A second aperture is put at the image-plane (A^2). Both apertures should have a diameter of about 10—15 mm. (a hole in a card). A screen is placed behind the second aperture. The arrangement is shown in Fig. 16.

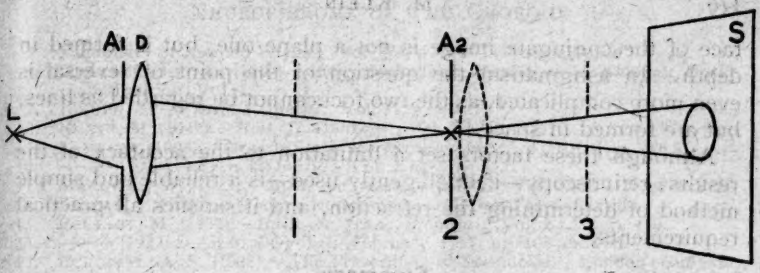

FIG. 16.

L A_1 D corresponds to the patient's eye. A_2 S to the observer's eye in retinoscopy.

The size of the light-patch on the screen will increase with the distance of the screen from the second aperture. But as the distance between the observer's retina and pupil is constant, the factor of distance of the screen from the second aperture (observer's pupil), can be regarded as constant. The size of the light-patch on the screen depends thus upon the size of the first aperture only. If the first aperture is replaced by a smaller or larger one, the size of the light-patch will alter accordingly. If a convex lens (*e.g.*, +14 D) is put close behind the second aperture, no change in the size of the light-patch ensues. In this experiment the light-source may be regarded as the patient's retina, the first aperture as the patient's pupil, the lens (D) as the patient's refractive system; the second aperture and the screen as the observer's pupil (or mirror-hole) and retina. This experiment shows that at the point of reversal the illuminated light-patch on the observer's retina is determined by the size of the patient's pupil. In position 2, *i.e.*, the point of reversal a sudden change of light and shadow can be observed. By moving the second aperture from this point in either direction (1 and 3), and by moving the light it can be demonstrated that the shadow moves *with* in position 1 and *against* in position 3.

(*c*) *Factors influencing the point of reversal. Limitations of retinoscopy.*

The rôle of the mirror-hole is this. The smaller it is the sharper will be the point of reversal. But the size of the mirror-hole, or examiner's pupil is only one of the factors influencing the point of reversal.

There is, even in the case of sharp focus a high degree of aberration, and consequently large confusion circles arise. The decentration of the cornea, the spherical aberration of the refractive media, the size of the retinal light-patch (which acts in retinoscopy as a light-source) exclude a " point " of reversal because the sur-

face of the conjugate image is not a plane one, but is formed in depth. In astigmatism the question of the point of reversal is even more complicated, as the two foci cannot be regarded as lines, but are formed in space.

Although these factors set a limitation to the accuracy of the results; retinoscopy—if intelligently used—is a reliable and simple method of determining the refraction, and it satisfies all practical requirements.

Summary

The nature of the light-pencil emitted by the patient's eye during retinoscopy is best understood on the basis of the projection theory.

Retinoscopy is an aperture-test by means of which the point of reversal is determined of a myopic eye, or of an eye made myopic by trial lenses.

The elements of the illumination and of the returning observation systems of retinoscopy are analysed.

Factors.—(1) Retinoscopic field can be substituted by the mirror-hole.

(2) Speed of reflex-movement is explained by the area of the cross-section of the emitted light-pencil at the plane of the retinoscopic mirror.

(3) In the brightness of the pupillary light the factors are: (*a*) brightness of the source, (*b*) distances, (*c*) apertures, and (*d*) losses in transmission, and the vergence of the emitted light-pencil.

(4) The retinoscopic reflex seen in the pupil is influenced by the size of the original source of light, and the mirror used.

(5) Factors influencing the point of reversal.

(*a*) Explanation of the sudden change of light and shadow at the point of reversal.

(*b*) The observer's retina receives during retinoscopy image elements of the patient's fundus or confusion circles of it, depending upon the vergence of the emitted light-pencil. The size of the confusion circles is maximum at the point of reversal.

(*c*) The factors influencing the point of reversal set a limit to the accuracy of retinoscopy.

My thanks are due to Mr. Frederick Ridley for many valuable suggestions and for his ready help in preparation of this paper. I am obliged to Mrs. E. Clayton for making the diagrams, and to Messrs. Keeler for the drawing of Fig. 9.

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CASE OF NEUROFIBROMA OF THE CHOROID*

BY

Capt. P. D. TREVOR-ROPER, N.Z.M.C.

NEUROFIBROMA of the choroid is an extremely rare disease; so that any instance of it deserves reporting; recently a case has reached Moorfields, which, in many respects, is unique among the few on record.

Case History.—M. C., a girl aged 3½ years, had been noticed for the previous 4 months to have an increasing prominence of the left eye, being well in every other respect. She was then shown to her doctor, who referred her directly to Moorfields, and the following signs were evident:—The right eye was normal. The left eye was moderately proptosed, with some limitation of all movements, especially on looking upwards. There was no other abnormality save on ophthalmoscopic examination, which revealed a globular mass almost filling the supero-temporal quadrant, whiter than the adjacent choroid, but with distinct choroidal blood-vessels on its surface, and normal retinal blood-vessels directly overlying it; there was no pigmentary proliferation. The mass was sharply demarcated, almost reaching the optic disc; at the lower border was a trace of fluid detachment; elsewhere the fundus was normal.

The appearance was thus similar to that of a choroidal sarcoma with extra-ocular extension, but the age of the patient prevented this diagnosis.

X-ray and general examination showed no evidence of metastases or other abnormalities.

On May 14, 1943, Mr. Doyne performed an exploration of the

* Shown at the Section of Ophthalmology, Royal Society of Medicine, November 12, 1943.

left orbit, through division of the conjunctiva between the superior and external recti, and exposed a firm, circumscribed tumour, extending back from the sclera towards the apex of the orbit, transillumination showing the detachment to be opaque, exenteration of the orbit was effected forthwith. The socket healed well and has given her no trouble since then.

Pathology.—I am indebted to Mr. Goldsmith for permission to retail his report on the pathology of the tumour.

"The specimen consisted of the left orbital contents. The orbital fat and muscles were removed, exposing the left globe with a soft whitish mass adherent to it in the region of the insertion of the superior oblique muscle. This mass was irregularly lobulated and approximately equal in size to the globe itself. It had displaced the optic nerve downwards and inwards, and had caused considerable distortion and indentation of the whole posterior part of the eye. It was apparently encapsulated, and not invading the orbital tissues.

"The eye and mass were divided in a slightly oblique plane passing downwards and inwards. As is well shown in the illustration the mass was now seen to be composed of a smaller smooth rounded intra-ocular portion in the choroid, communicating through a fairly wide scleral perforation with a much larger irregular lobulated extra-ocular extension. The cut surface of the mass was yellowish in

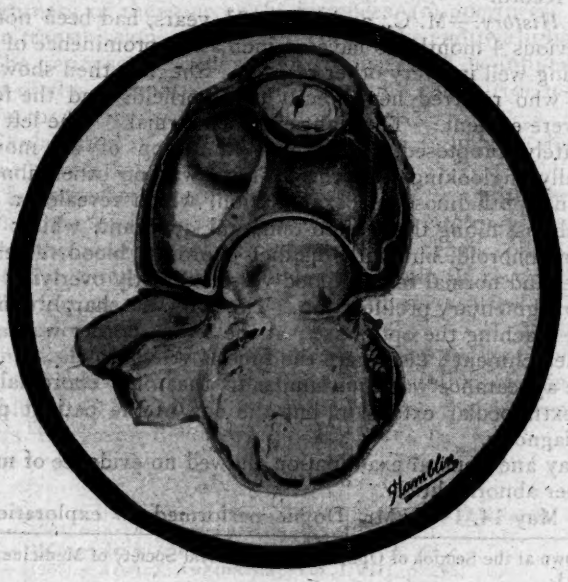

FIG. 1.

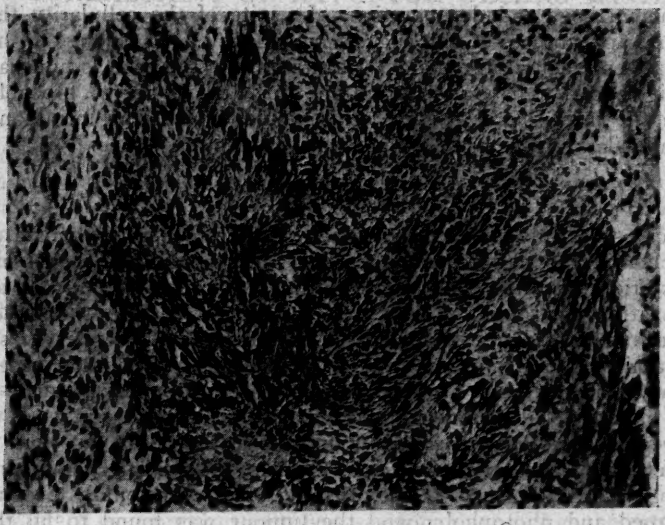

FIG 2.

colour and fairly soft in consistency, although crossed in places by firmer trabeculae of fibrous tissue. Half of the bisected specimen was embedded in celloidin, and sections were cut and stained with haematoxylin and eosin, and with haematoxylin and van Gieson's stain."

Histology

The anterior segment of the eye is normal. To the general architectural features as seen with the naked eye and loupe and noted above, the microscope adds the facts that the retina, although raised over the intra-ocular part of the mass, is otherwise entirely unaffected. The tumour also has not invaded the constituent elements of the choroid, which is stretched out over its surface, the lamina vitrea being intact. A fairly large scleral perforation is present and the scleral edges have caused a constriction in the mass. The sclera is not invaded and its margins appear to have been separated by direct pressure.

The tumour itself has a well defined fibrous capsule, although this is poorly developed over the intra-ocular portion. It is composed of elongated cells showing well marked parallel arrangement, and many areas of palisading. It is unusually cellular, and there are a few mitoses. Collagen formation is correspondingly scanty but well developed fibrous septa can be seen, and there is

some collagen formation in the cell bundles. There are small areas of haemorrhage and degeneration. In spite of the cellularity the general appearances do not suggest malignancy. It belongs to the group of perineural fibromata. Its situation in the orbit is unusual, and it appears to have arisen from one of the ciliary nerves, probably from the intra-scleral portion; this would explain the intra- and extra-ocular extensions of a non-invasive tumour.

Discussion

I can find only six recorded cases of discrete neurofibromata of the choroid; as in this case the majority are in a situation suggesting their origin from the ciliary nerve, although in one of them such an association was sought in vain. In common with the other cases there was no evidence of generalised von Recklinghausen's disease, no family history, and, as yet, no recurrences. The other cases, however are virtually confined to adults, the youngest instance—that of Kyrieleis—commencing as a small limbal tumour in a girl of 12 years. Two other cases show unusual features:—

In that of Papoleczy, a man aged 43 years, the eye had been shrunk from birth, and, since 18 months old, had occasionally become inflamed and photophobic, and the tumour was found to fill the globe, about the size of a hazel nut.

And in that of Callender and Thigpen, two tumours, the size of a pea, were present in the anterior and posterior regions of the same eye.

In contrast to these, a diffuse neurofibromatosis of the choroid occurs more frequently, usually in infants and resulting in glaucoma, and is usually associated with evidences of von Recklinghausen's disease elsewhere.

I am indebted to Mr. Doyne for permission to report this case, and to the Laboratory at Westminster Hospital for preparation of the microphotograph.

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TREATMENT OF HYPOPYON ULCERS WITH ALBUCID AND PROFLAVINE*

BY

Capt. P. D. TREVOR-ROPER, N.Z.M.C.

ALTHOUGH the number of cases that I have treated has been lamentably small, I feel justified in mentioning them partly because circumstances are now so rare which allow an assessment of novel treatments on any quantity of in-patients—and so far as I know this has not yet been performed for albucid—and partly also in the desire to bring to notice the use of proflavine as an antiseptic for the conjunctival sac.

Albucid has been shown to be an effective bactericide when introduced into the conjunctival sac, and one which penetrates the corneal tissues well; and although there is little recorded clinical evidence of its value, it has already become widely adopted as a routine treatment of corneal and conjunctival infections. Eighteen months ago I published a series of out-patient cases (conjunctivitis and corneal ulcers), treated with albucid drops, and in these no advantage over previous methods was apparent; but as the patients could not be persuaded to instill the drops more than thrice daily this does not criticise its use in the more serious cases where hospitalisation is necessary.

Recently I have treated a similar series of in-patient cases of hypopyon ulcer with albucid, instilling 30 per cent. drops hourly by day and 10 per cent. ointment 4-hourly by night for 4 days, then 10 per cent. ointment thrice daily; in four cases I used the glass shell container as advocated by Brigadier Scott so as to keep the albucid solution in contact with the eye for a longer time (10 minutes in practice) but this so irritated the inflamed eye that none could well tolerate it. As the results were not encouraging, in the next dozen cases I used proflavine for a course of three days with an irrigation of 0·1 per cent. solution of proflavine in saline 2-hourly by day and 4-hourly by night, and material improvement ensued.

Proflavine is a recently introduced flavine derivative of great bactericidal power, inhibiting *in vitro* staph. aureus in 1/10,000 concentration or 1/80.000 in the absence of serum, and pneumococcus in 1/100,000 in the presence or absence of serum; the toxicity to tissues is considerably less than that of the other flavine antiseptics, indeed so non-toxic as to justify its wide use as a powder in general surgery, very little microscopical tissue damage has been shown by Professor McIntosh to be thus produced, and Mr. Mottram has shown that no ill-effects follow injection of ½ c.c.

*Read at the meeting of the Section of Ophthalmology, Royal Society of Medicine, November 12, 1943.

1/1,000 proflavine in saline into the tail vein of the mouse. Finally no signs of irritation have been observed after its introduction into the conjunctival sac of patients.

CASES TREATED WITH ALBUCID

Name	Age	Culture	Previous history	Size of Hypopyon	Result
J. H.	53	Pneumococcus	Painful 4 days	1½ mms.	Hypopyon cleared in 5 days
B. J.	66	—	—	1½ mms.	Hypopyon cleared in 9 days
J. B.	58	—	Painful 1 month	2 mms.	Hypopyon cleared in 5 days
N. C.	42	—	Painful 6 weeks	1 mm.	Hypopyon cleared in 4 days
H. G.	66	—	Painful 4 days	1½ mms.	Hypopyon cleared in 4 days
A. M.	59	—	Painful 3 days	1 mm.	Hypopyon cleared in 5 days
L. P.	44	—	—	1 mm.	Transferred I. S. Q. in 3 days
J. H.	36	Pneumobacillus and s. aureus	Painful 4 weeks	2 mms.	Transferred I. S. Q. in 21 days
F. D.	48	—	Painful 2 days	2 mms.	Transferred I. S. Q. in 42 days, finally healed after T.A.B. injection
F. J.	19	—	Painful 10 days	2 mms.	Saemisch section 11 days
T. G.	80	—	Painful 2 days	2 mms.	Saemisch section in 10 days followed by evisceration
F. W.	82	—	Painful 2 days	3 mms.	Saemisch section in 10 days followed by evisceration

TREATED WITH ORAL SULPHAPYRIDINE

Name	Age	Culture	Previous history	Size of Hypopyon	Result
J. C.	8	—	Painful 2 days	2 mms.	Evisceration in 16 days

CASES TREATED WITH PROFLAVINE

Hypopyon Ulcers

Name	Age	Culture	Previous history	Size of Hypopyon	Result
W. M.	57	—	Abrasion 4 days before	2 mms.	Hypopyon cleared in 2 days
A. D.	43	—	—	1 mm.	Hypopyon cleared in 2 days

CASES TREATED WITH PROFLAVINE—*continued.*

Hypopyon Ulcers

Name	Age	Culture	Previous history	Size of Hypopyon	Result
F. S.	40	Pneumobacillus	Abrasion 2 days before	1 mm.	Hypopyon cleared in 1 day
F. P.	46	—	F.B. 2 days before	3 mms.	Hypopyon cleared in 5 days
J. F.	17	Pneumococcus	F.B. 1 day before	2 mms.	Hypopyon cleared in 2 days
J. B.	8	—	—	1 mm.	Hypopyon cleared in 1 day
E. M.	58	—	Sore 7 days	2 mms.	Hypopyon cleared in 3 days
H. B.	47	—	F.B. 4 days	1½ mms.	Hypopyon cleared in 1 day
W. C.	46	—	Ulcer treated for 1/12 following F.B.	1½ mms.	Hypopyon cleared in 1 day, recurred from 3rd to 5th day after discontinuance of proflavine
E. W.	66	—	Sore 4 days before	2 mms.	Saemisch section 5 days
J. R.	71	—	—	2 mms.	Saemisch section 7 days
C. K.	62	—	Abrasion 4 days before	3 mms.	Saemisch section 2 days
Hypopyon Iritis					
D. C.	47	—	Relapse 3 days before	1 mm.	Hypopyon cleared in 2 days
R. H.	44	—	Painful 30 days	1 mm.	Hypopyon cleared in 1 day
J. H.	47	—	Relapse 4 days before	2 mms.	Hypopyon cleared in 1 day, recurrence in 3 days and then cleared in further 5 days

In all cases atropine, heat, diathermy, covering and rest were given in addition to the specific drug mentioned.

It will be seen that 12 cases of hypopyon ulcers have been treated with albucid, 12 with proflavine, and 1 with oral sulphapyridine (as the latter had an untoward end this was not tried again); three cases also of hypopyon iritis received the regime of proflavine irrigations and all rapidly responded.

In all but four cases no pathogenic bacteria were found on culture from the conjunctival sac; and in these four, further culture after use of the bactericide was sterile.

In three of each series of 12, usually in the very old cases, Saemisch section was required, those in the proflavine series being all over 60, and the two octogenarians of the albucid series both lost the eye. In the remaining 18 cases, all had a history of only a few days of pain; in all those treated with proflavine the hypopyon cleared rapidly in an average of two days; but among those treated

with albucid, in 6 the hypopyon cleared in an average of 5·3 days, and in the remaining 3 it was still present on their transference to a base hospital in 3, 21 and 42 days respectively.

Although as a criterion of efficacy the clearance of the hypopyon is not without criticism, it was the only one practicable since it was sometimes necessary to discharge the patient before the final healing of the ulcer itself owing to shortage of beds.

It is of interest that one persistent hypopyon cleared only after a course of T.A.B. injections, and in several cases the ulcer itself healed only, but then invariably, after recourse to the latter.

This assay is far from comprehensive, but there seems little doubt that proflavine will be of value in superficial eye infections, especially when the optimum vehicle and concentrations have been determined.

I should like to thank Mr. Mottram and Professor McIntosh for their help and the use of their unpublished findings.

A CASE OF EXUDATIVE AND HAEMORRHAGIC RETINITIS, WITH INCREASED INTRA-OCULAR TENSION, TREATED BY PILOCARPINE AND THYROID*

BY

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PATIENT P., female, age 40 years, married, nulliparous, reported to us in December, 1941. She complained of a troublesome pain in her right eye-ball, and right-sided headaches, and stated that her right eye had been blind for two years.

In 1937 she was involved in a motor accident receiving a severe blow above her right eye. A week later she noticed a dark spot in front of her eye. An ophthalmologist found a patchy retinal haemorrhage. Since the accident her sight has become steadily worse and, being haunted by the fear of blindness, the patient commenced a "pilgrimage" all over Europe from one eye specialist to another.

Two months after the accident, one of the specialists found increased intra-ocular tension and performed an anti-glaucomatous

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operation. This relieved the headaches, but the sight was still failing and, in 1939, she lost it completely and the headaches returned.

On examination (October, 1941): Right eye, V.—0; Tension—90 mm. Hg (Schiotz) congestion of anterior ciliary veins, cloudy cornea. Shallow anterior chamber half-filled with blood. Iris atrophied, artificial coloboma directed upwards. Fundus oculi could not be seen. Left eye: No pathological changes. V.—6/5; tension—normal.

Previous history.—In childhood; scarlet fever and encephalitis. Tonsillectomy. Patient states that her only pregnancy was artificially ended on account of biliary colic. During the last two years, from our observation, no signs or symptoms of biliary attacks have been noticed.

Family history.—Patient's mother suffered from glaucoma. Operated on with good results.

The first time the patient was admitted to the hospital (January 14, 1942) medical and neurological examinations revealed no signs of abnormality. Gynaecologist reported uterine fibroids. Blood pressure 120/90, chemical, serological and morphological examination of blood—negative. Urine normal.

The right eye-ball was removed and, ten days later, a myomectomy was performed. Her convalescence was uneventful after both operations and, having made a good recovery, she was discharged (March 4, 1942).

Five months later she came back to the hospital with a new history. A week after the extraction of two teeth, under general anaesthesia, a dark spot appeared in front of the remaining (left) eye. Ophthalmoscopy revealed numerous haemorrhages and patches of exudate in the vicinity of the optic disc. One characteristically woolly patch of exudate was situated close to the disc. V.—6/18.

She was re-admitted (July 10, 1942) and, during the first month in hospital, her sight grew much worse and eventually she had an attack of glaucoma with considerably increased intra-ocular tension. The attack was relieved by pilocarpine, but the vision was deteriorating and finally it became limited to counting fingers from a distance of eighteen inches. In order to keep the tension down it was necessary to instill 2 per cent. pilocarpine t.i.d. or l.i.d.

In summing up we have dealt with a case of retinopathy complicated by an increased intra-ocular tension in an apparently healthy woman.

The course of such cases is identical with that of glaucoma associated with thrombosis of the retinal vein; haemorrhagic malignant glaucoma rapidly leads to total blindness, as was the case with the right eye of our patient.

The gravity of the condition indicated clearly that the morbid process in the left eye was a repetition of that of the right eye and

this compelled us to undertake a detailed revision of the case from both a pathological and a therapeutic point of view. Previous experience stressed the futility of all local treatments including operative, and the observation confirmed the imminent danger of blindness.

In our case the ophthalmoscopic picture of the fundus was similar to severe hypertensive retinopathy. Taking into consideration that the retinal changes in hypertension are caused by the diseased arterioles and our patient's blood pressure was normal (Mx. 120, Mm. 90), we were forced to conclude that it was a case of arteriolitis of unknown origin, which F. Duggan recently pointed out (*Amer. Jl. of Ophthal.*, 1943, Vol. XXVI, No. 4, p. 354).

We started protein shock therapy, injecting sterilised milk every second or third day, beginning with 5 c.c., then 10 c.c. and 15 c.c. After the third injection the patient had high fever and glaucomatous reaction; repeated instillations of pilocarpine were needed to stop this reaction. This therapeutic failure was probably due to the fact that, in the first stage, the effect of the induced hyperthermic shock caused a spasm of the eye arterioles,

In search of a new general therapeutic method in order to supplement the impotent local eye treatment we recalled old research works of the French school, especially those of Chauffard and his pupils (Laroche et Grigaut, Annales de Medicine, Vol. VIII, 1920, pp. 69-91, 149-172, 321-334; Gaudissart, Presse Médicale, 1921, pp. 893-895). They revealed that exudative patches of retinitis contain many lipoids especially cholesterol esters, and that such retinopathy is associated with hypercholesterolaemia. The blood cholesterol of our patient was 180 mgm. per cent. which is the upper normal limit; the B.M.R. (Haldane's apparatus) was estimated at minus 10 per cent.

In our opinion, the upper limit of blood cholesterol and the basal metabolic rate below zero was an indication to administer thyroid treatment, which at the same time is a factor accelerating the circulation time.*

The patient was given thyroid tablets gr. 1 t.i.d. from July 29, 1942, to October 10, 1942. From the beginning of this treatment vision started to improve, slowly but nevertheless steadily. Patient had no more glaucoma attacks. Her weight was fixed at 54·5 kilos, her basal metabolic rate did not alter and, in order to avoid the general action of the thyroid (heart palpitation, tachycardia, perspiration, insomnia), she was taking ½ gr. phenobarbitone, twice daily. It is unnecessary to underline that advanced improvement of the eye was coupled with improved general condition. From October 10, 1942, until January 16, 1943, thyroid was discontinued. During

* Because of the invisibility of the patient's veins it was impossible to get blood for repeated cholesterol and circulation time tests.

this period the patient was given six injections of 0·1 acetylcholine which were followed by abdominal cramps, and for many weeks afterwards she was given 0·05 nicotinic acid, t.i.d., because of its vasodilatory action. Since January 16, 1943, she has been taking thyroid again, one tablet, gr. 1 every second day with additional phenobarbitone, tablet gr. ½, twice daily.

Under the thyroid treatment the condition of the left eye began to improve; the haemorrhages disappeared as did the exudates in the fundus. Intra-ocular tension became normal with only one instillation of pilocarpine daily. Vision increased to 6/18 and she could read J. 4 print. After many months treatment she can now write and read letters, walk alone, recognise friends and bus numbers from a distance.

We do not know whether the condition is now permanently controlled and the patient is therefore under constant supervision. The last examination was on October 1, 1943.

Summary

A case of retinopathy in an apparently healthy woman of 40 years was complicated by increased intra-ocular tension. We assume that thyroid treatment prevented glaucoma from taking a haemorrhagic malignant course which is usually the case and evidently happened in the case of the patient's right eye.

It is our intention, therefore, in cases of retinopathy of unknown nature to take the B.M.R. and blood cholesterol test. If cholesterol is high and/or B.M.R. low, we suggest thyroid treatment. In the opinion of W. F. Duggan, every retinopathy, especially of unknown origin, should be treated by vasodilatory methods.

A CASE OF PRIMARY CHANCRE OF THE BULBAR CONJUNCTIVA

BY

Major C. DEE SHAPLAND

R.A.M.C.

PRIMARY chancre of the conjunctiva is rare. Isolated examples have appeared from time to time in the literature (*vide infra*), a perusal of which would suggest that the eyelids, especially the lower, are less rarely affected than the conjunctiva and that a primary syphilitic lesion of the eye or its appendages is more common on the Continent than in this country. Neither Lt.-Col. A. King, in charge of an Army Venereal Diseases Division, and before the

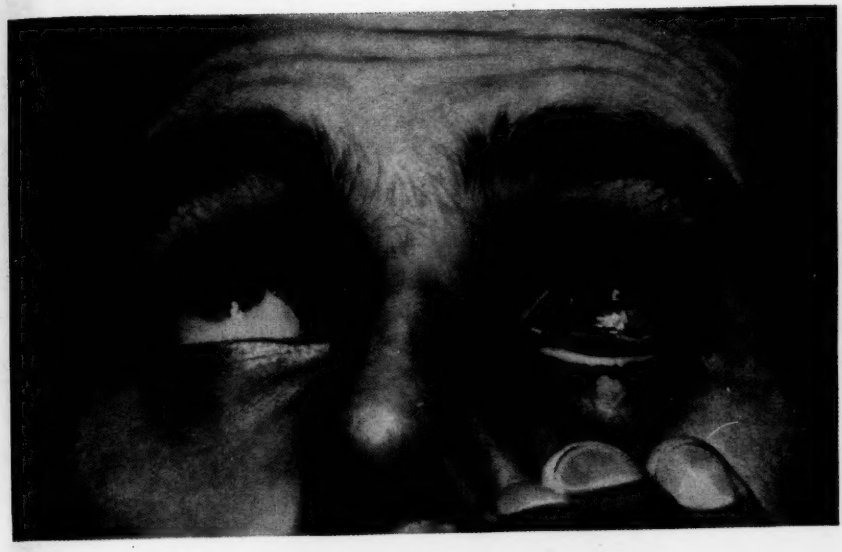
War chief assistant at the Whitechapel Clinic, nor myself at Moorfields Eye Hospital had seen an example, so it would appear that this case is worthy of placing on record.

E. M., aged 20 years, of the R.M. Division, attended the Ophthalmic Department on May 12, 1943, on account of inflammation of, and slight discharge from, the left eye for the previous ten days. He had had no previous eye trouble. The patient, a well-developed young man, showed slight oedema of both lids of the left eye, the plica semi-lunaris and caruncle of which were unduly evident in the area exposed in the palpebral fissure which was somewhat narrowed by the oedema. Swellings in the left parotid and sub-maxillary regions were visible and due to enlargement, firm and discrete, of the lymphatic glands in those situations.

An indurated band of cartilaginous consistence was palpable through the lower lid and sprung into view with ease on its eversion. This band was then seen to be directly continuous with the lower end of the enlarged and oedematous plica, and laterally became lost on the bulbar conjunctiva infero-temporally. On it at the junction of its inner and middle thirds was a small, greyish-white ulcer, some 4 mm. long by 1½ mm. broad with well defined sharp edges and grey sloughing base. The bulbar conjunctiva was slightly chemotic and showed a cyanotic tinge. There was practically no discharge. The cornea was bright and showed no stain with fluorescein; the media of the eye were clear and fundus normal. Visual acuity was 6/9 pt. unaided.

The diagnosis of primary chancre of the conjunctiva was confirmed on May 14, 1943, by a specimen of serum from the ulcer being positive to a dark field examination for the treponema pallidum. Blood for a Wassermann taken the day previously was weakly positive as also was a Kahnn reaction. Exposure to infection on two occasions with the same consort, ten days and also four months previously, was admitted. On May 14, 1943, the patient was given 0·04 gm. mapharside intravenously and bismostab 0·2 gm. intramuscularly, thereafter he received 0·06 gm. mapharside twice weekly and the bismostab injections once weekly until July 2, 1943, when he was transferred to North Wales. By this time he had received a total of 0·88 gm. mapharside and 1·9 gm. of bismostab.

Discharge from the left eye had ceased by the third day after the first injections on May 14, and the ulcer had completely disappeared by the seventh day. The indurated band in the lower fornix, however, remained practically unchanged for two weeks both in appearance and consistence, but then gradually retrogressed and a month later was no longer palpable through the lower lid but was still visible on its eversion. Recognisable enlargement of the pre-auricular gland had disappeared a fortnight after the first injection and that of the sub-maxillary group a week later, these glands



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remained palpable, however, up to the time of his discharge from hospital on July 2. By this time the left eye had returned to normal except for a somewhat thickened plica at the lower extremity of which the remains of the indurated band curving into the lower fornix was still just visible.

The colour photo was taken on May 14, 1943, whilst the drawing was made on the following day, twenty-four hours after the first injections; even by then the ulcer had appreciably retrogressed.

I am indebted to Lt.-Col. A. King for the details of the anti-syphilitic treatment given to this patient and for the dark field examination.

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A CASE OF ADIE'S SYNDROME*

BY

Squadron-Leader THEODORE JAMES, M.B., CH.B.

CAPE TOWN

IN April, 1943, I saw a male patient, aged 21 years, who complained of a minor ailment, a slight weakness of the abdominal wall following appendicectomy. At the same time it was observed that his pupils were unequal, the right being about two thirds the size of the left. When he was questioned he replied that he knew of this inequality of the pupils and that he had first noticed it about one year previously when he was looking into a mirror, at a small stye. He had since, paid little or no further attention to the pupillary inequality.

In July, 1941, he noticed that his vision at times was momentarily blurred when he looked from a near to a distant object and vice versa. The blurring of vision did not last longer than two seconds. Occasionally he also experienced diplopia, also momentarily. Because of this he consulted an ophthalmologist who diagnosed a compound hypermetropic astigmatism and lenses were accordingly prescribed, obtained and worn with a beneficial result. The wearing of the lenses did not restore the equality of the pupils and the probability that the abnormality was not due to an error of ocular refraction was considered and investigated.

His father and mother are both well and have a good medical history.

Apart from the pupillary abnormality the eyes were normal in every other respect, no irregularity nor eccentricity, synechiae nor pathology such as atrophy of the iris. The lenses, fundi, optic discs and ocular tension were normal. The right pupil was two thirds the size of the left. When the pupils were tested for convergence accommodation there was no apparent pupillary response of the right eye only. There was apparent abolition of the light reflex and of the consensual photomotor reflex from the same eye. Exposure to darkness for five minutes and subsequent exposure to light did not elicit the light reflex, nor did forced closure of the eyelids (Piltz—Westphal). Pinching of the cervical skin failed to stimulate dilatation of the pupils. There was no hippus nor a change in the size of the pupils when the eyes were abducted (Tournay's) but corneal stimulation produced a just detectable contraction.

A mydriatic instillation of ½ per cent. atropine sulphate solution resulted in fairly rapid dilatation of both pupils but when both were maximally dilated the relative sizes of the two pupils

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remained the same, the right two thirds the size of the left. As the effect of the atropine wore off the pupils retained their relative sizes.

The instillation of ½ per cent. eserine into the eyes resulted in equal maximal contraction of the pupils.

A test suggested by Kyrieleis Werner was made. Strychnine sulphate, gr. 1/60 was subcutaneously injected and the pupillary reactions tested two minutes after the injection, then after thirty minute, sixty minute, 12 hour and 36 hour intervals. At the end of the thirty minute interval pupillary accommodation to convergence was just detectable but delayed over about 10 seconds; but there was no light reflex and at the end of the sixty minute interval this reflex was doubtful. Twelve hours after the strychnine injection his convergence accommodation was present but minimal and so was his light reflex but not the consensual photomotor reflex. Thirty-six hours later there were delayed convergence accommodation, consensual photomotor reflex and light reflex, each taking about 5 seconds for completion but the range of dilatation and contraction was small and there was no extreme contraction, the resting size of the pupil being a third the diameter of the cornea. Ten days later convergence accommodation was apparent only after 20 seconds. The light and consensual photomotor reflexes were again not apparent. The size of the pupil did not appear to vary from day to day nor was it found to be larger in the early morning than it was later in the day. Fifteen days later when again examined there was apparent but slight delayed reaction to accommodation and to light which took 5 seconds in both instances for completion of the reflex; but there was no consensual reflex apparent. The pupil with the eye at rest tended consistently to maintain a diameter of 3 mm. throughout the day and from day to day.

Examination of the nervous system disclosed the following abnormalities. The right knee jerk was absent although a weak contraction of the quadriceps muscle could be detected, only with "re-inforcement." Both ankle jerks were absent. These deep reflexes remained constant. Superficial reflexes were normal. There were no pains or cramps in the limbs nor a history of such symptoms. Both triceps jerks and the left knee jerk were normal. The Kahn reaction of the blood serum gave a negative result. In all respects the patient was a fit and healthy individual leading a perfectly normal life and there was evidence that in 1940 all his tendon reflexes were normal.

Conclusion

This case of Adie's syndrome did not present all the features of the typical syndrome, persistently. At times the delayed "tonic"

pupillary reactions were evident and at other times were not apparent or doubtful. The consistent smallness of the right pupil compared with the left and its strong tendency to maintain a constant size, at first seems to indicate a parasympathetic tonus of the sphincter pupillae; but a fact, that complete dilatation of the pupil did not follow atropine mydriasis suggests the contrary, a hypotonic state of the dilatator pupillae, so that it is reasonable to assume

(1) that the relative smallness of the pupil was due also, to a relative hypertonicity of the sphincter pupillae over the dilatator or

(2) because the actual size of the pupil remained moderate that there was an almost atonic nervous balance.

However, it appears that the one-time anatomic and physiologic distinctions between the sympathetic and para-sympathetic systems do not carry quite the same weight and that there is a strong tendency to name the two parts of the autonomic nervous system, acetylcholine secretory (cholinergic) and adrenaline-like substance secretory (adrenergic).

Recent evidence has also been forthcoming that the autonomic and somatic nervous systems are closely knit and as Boelke has shown, the sympathetic nerve fibres are closely associated with the fibres of voluntary muscle, and Hunter and Royle believed that sympathetic nerve fibres had much to do with muscle tone.

These endeavours, to illustrate the functional import of the sympathetic with the somatic system, together with the correlation of the functional activities of the sympathetic and parasympathetic systems, bring even stronger indications of the interdependence of the autonomic and somatic nervous systems.

It is, therefore, submitted, that the delayed " tonic " pupillary reflexes of Adie are in reality " atonic " and due to a generalised nervous asthenia, the degree of which might vary from time to time with a corresponding effect upon the pupils which are much more sensitive to such variations than are the absent or sluggish tendon reflexes. Kyrieleis Werner's procedure appears to support this.

The benign and non-syphilitic nature of the syndrome in a young and healthy individual, who is capable of leading a normal life, is confirmed and its detection appears to be a matter of chance. Its recognition, however, from the point of view of insurance companies should become established among insurance company doctors, otherwise the likelihood of a prospective policy being refused because of the absent reflexes with the usual implication, is great.

Summary

1. A case of Adie's syndrome is described.

2. Clinical tests which have at one time or another been advocated were carried out.

3. A hypothesis to explain the syndrome is submitted.

4. Its importance from the insurance companies' point of view is stressed.

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ANNOTATION

"Service" Burns

The burns inflicted on airmen, naval gunners from the back-flash in a turret, and tank crews affect the exposed parts of the body, that is the face and hands, and are characteristically encircling burns. Both the palmar and dorsal surfaces of the hands are commonly involved and so are the ears and scalp. The ophthalmologist is concerned in burns of the face where a third degree burn of the eyelids often ends in cicatricial ectropion with such complications as exposure keratitis and corneal ulceration. Those who survive by escaping within 5 seconds of the onset of the fire are not burnt in parts of the body protected by even one layer of clothing. The majority of accidental fires occur from a air-crash either shortly after the take-off or on landing. At such times it seems to be the habit of pilots to have their gloves off and their goggles pushed up on to the forehead. Gloves are put on when they are in the air and their course is set but goggles are sometimes discarded in combat. Naval gun crews are provided with an asbestos helmet and vizor which covers the scalp, face and neck leaving an aperture for the eyes, and gauntlets. It is probable that the asbestos is unnecessary and that any clothing material of reasonable thickness would give protection. Here, also, such protection is not favoured by the men and its importance unappreciated.

Much controversy has raged during the last twenty years about the treatment of burns and this subject is still under discussion. It is quite certain that the coagulants such as tannic acid should be condemned in the treatment of "service" burns of the face and hands. In the case of the face, tannic acid preparations applied

to the eyelids make these rigid and immobile and exposure corneal ulceration, conjunctivitis and panophthalmitis may follow. Secondary pyogenic infection is commonly present beneath the coagulum. In the hand the sequels of such treatment are intense oedema and pain, necrosis of the fingers and fibrinous exudate in the tendon sheaths which seriously impairs their function and renders the hand almost useless.

The diagnosis between a second and a third degree burn is often difficult. First and second degree burns will heal satisfactorily, the third degree burn is a surgical problem. About 80 per cent. of burns are infected by meddlesome first-aid treatment. Probably the best first-aid treatment to-date is to dust some sterile sulphanilamide powder over the burnt area and cover this with a sterile dry dressing. In an operating theatre with proper aseptic technique the burn is dressed and a diagnosis of its degree and distribution is made. After all blisters and tags of dead epithelium have been excised, the area is swabbed with CTAB (cetyl trimethyl ammonium bromide) and normal saline and penicillin, sulphanilamide and sulphathiazole in a cream base is applied and over this tulle gras and gauze wrung out in sterile normal saline.

In extensive third degree burns of the eyelids a tarsorrhaphy has to be considered. Fortunately the lid margins are spared in such burns and so tarsorrhaphy is possible. Tarsorrhaphy gives the lids a reasonable degree of rest and at the same time protects the cornea. However, this does not seem necessary in all cases for during the first 24 hours after the burns the swollen lids will cause occlusion of the palpebral fissure. In cases where the lids cover the eye tarsorrhaphy may be delayed or dispensed with.

Between the sixteenth and eighteenth days the sloughs over a third degree burn separate, cicatricial ectropion begins and this is the time for excision of scar tissue and the insertion of a skin graft. If there is an extensive area of both eyelids to be grafted a dermo-epidermal (Thiersch, split skin) graft is applied and sutured in position. When the area in the lower lid is 2cm. or less a full thickness (Wolfe) graft taken from behind the ear when this skin is available tones in well and its colour is ultimately more natural than that of the dermo-epidermal graft. Propamidine is useful in dealing with sulphanilamide resistant bacteria. It is plainly desirable that the injured tissues be free from pyogenic bacteria before a skin graft is applied although a large proportion of skin grafts have taken despite the presence of some bacterial infection in cases where grafting became imperative in order to save an eye from destruction.

THE TEARS

BY

FREDERICK RIDLEY

A MEETING of the Royal Eye Hospital Clinical Society was held on Friday, January 14, 1944.

Mr. Holmes-Smith, the Chairman, said he had particularly been looking forward to Mr. Ridley's lecture-demonstration as he had found the important subject of the tears very cursorily dealt with in the text-books.

Mr. Frederick Ridley said that he was not surprised that the Chairman found it difficult to get succinct information about the tears. A great deal of research work had been done; but the results were scattered through the journals. He proposed in his lecture to summarise some of the more salient points.

Much of the older work had been vitiated by faulty methods of collection of the tears, particularly by allowing evaporation of the collected fluid. This was why many of the analyses gave far too high a figure for the sodium chloride content, which was actually only 0·65 per cent. Tears were best collected in a hard glass, Wright's capsule, which sucked up the tears by capillarity. After collection of the tears the ends of the capsule could be sealed off in a bunsen flame. It was difficult to get enough unless a reflex flow of secretion was provoked. This could easily be done by a drop of lemon juice on the caruncle, or by applying a tiny drop of absolute alcohol with an applicator.

Mr. Ridley emphasised the importance of the albumen and globulin content of the tears. These proteins were species-specific, and accounted for 0·669 per cent. Mr. Ridley boiled some tears in a small test-tube and pointed out that they coagulated. He shook up another small sample of tears, and they frothed. Both these demonstrations depended on the protein content of the tears.

This protein content was important too for purposes of surface tension. There was not really a cornea-air interface as we tended to let ourselves suppose. It was really a tears-air interface; and for the maintenance of an adequate surface tension in this thin film the protein was essential. Its presence also affected the permeability of the cornea to drugs.

What was the best vehicle in which we could apply drugs to the eye so that they would quickly and efficiently penetrate the cornea in adequate concentration? Dr. Miklos Klein had shewed that the ordinary ointment vehicles produced an aqueous solution of the contained drug in the form of a simple mixture or an emulsion in which the outer emulsion phase was oily. Clearly a true emulsion should be formed, not a mixture which is imperfect and tends to separate out, and the emulsion should not imprison the water dissolved drug in an impermeable oily coating. Klein had pointed

out that mono-glyceryl-stearate, available commercially as Tegin, formed true emulsions of the right type, was non-irritant and could be autoclaved without destroying either the base or the emulsion. It can be preserved indefinitely by a preservative such as 0·1 per cent. nipagin.

Lysozyme was a constituent of the tears of the greatest clinical and theoretical importance. Mr. Ridley recounted how it had been discovered by Prof. Fleming in much the same way as had Penicillin. When plating out sputum the plate was accidentally contaminated with a colony of M. lysodeicticus. Fleming noticed that the colony did not grow on to the sputum covered part of the plate but was sharply cut off. Investigation shewed this was because the sputum contained lysozyme, a bacterial inhibitor capable of acting in high dilution, but destroyed by heat. Lysozyme was present in tears, saliva, sputum, skin, and in the leucocytes. Our domestic chickens eggs would all addle if egg white did not contain a high concentration of lysozyme.

Lysozyme rapidly became ineffective below a certain fairly critical dilution for each sensitive organism. Thus M. lysodeicticus, the most sensitive of all bacteria is dissolved at 37° C. in a dilution of one in five million tears, in twenty-four hours. Plates were shown in which the growth of recently isolated strains of staphylococcus and hæmolytic streptococcus were completely inhibited by concentrations of 1/5 and 4/5 tears-saline dilutions respectively. He drew attention particularly to the fact that the streptococci grew freely when the dilution was equal to 3/5 tears-saline. Normal tears are very effective against even virulent organisms but there is not much margin. Epiphora lasting a few hours produces a reduction of lysozyme titre down to as little as 25 per cent. and then any bacteria in the area grow out and conjunctivitis and keratitis result. By repeated estimations in a series of cases it had been possible to compare the lysozyme titre of normal tears with that of tears in various inflammatory conditions of the eye. It was found consistently that the lysozyme was reduced below 60 per cent. in the active infective stage and that recovery was associated with a recovery to 75 per cent. titre or better. General causes, notably congenital syphilis, are often associated with a chronic deficiency in lysozyme.

Mr. Ridley then discussed the subject of atropine irritation. This was described by von Graefe; but was for many years uninvestigated. The condition occurred in both sexes, at all ages. Dermatitis from atropine had been reported as reaching as far as the umbilicus in an atropine sensitive patient. Atropine irritation was seldom seen in an uncongested eye and never occurred at the first instillation of the drug.

Waller had done useful pioneer work in which he suggested the irritant was a compound of atropine and tears protein. Later

research rather incriminated the protein from the conjunctival goblet cells.

Mr. Ridley divided patients with atropine irritation into two sub-groups. In the larger group the patients were only sensitive to higher concentrations of atropine, which caused chemical irritation. They were not sensitive to 1/800 atropine, so were readily treated by reducing the dilution. Most of them could tolerate atropine gr. 1/250 in lamellar form, or dilution of hyoscine 1/400.

The smaller group consisted of genuinely allergic patients in whom the atropine-protein compound acted as an antigen. These people could be desensitised by graded serum-atropine injections in about 10 days; but only to weak dilutions of atropine. They could not tolerate the chemical irritation of stronger solutions of atropine above 1/800.

In parenthesis Mr. Ridley mentioned that atropine drops exercise a local inhibition on the secretory activity of the lacrimal gland. This was important in eyes in which the lysozyme was lowered by prolonged lacrimation. The administration of atropine could lessen the watering, so that the tears would increase in their lysozyme titre, and recovery was thus hastened.

In the administration of drugs to the eye the influence of their dilution by the tears must not be forgotten. Most drops were diluted beyond useful value in 6 minutes. Zinc drops of course had a specific action in angular conjunctivitis. He thought irrigations by 1/1000 silver nitrate were of value, as also were argyrol and protargol. Mercurials, eusol, and copper salt solutions had a negligible value in therapeutic concentrations. Albucid solutions were rapidly diluted. Drugs such as fluorescein were absorbed by the tissue surfaces, and so had a longer effective action period.

In the subsequent discussion :—

Professor Sorsby asked whether the secretion of tears was in any way affected by the extent of the patient's saturation with vitamins. He showed a case of Sjogren's sydrome of kerato-conjunctivitis sicca from lack of tear secretion. The lacrimal secretion had appeared to increase after the administration of ascorbic acid. Conversely in this particular case the patient had developed his first symptoms of the associated arthritis while the vitamin was being administered.

Mr. Savin thanked the lecturer for a most instructive evening.

At Horton, Mr. Lumley had obtained excellent results with hypopyon ulcer by the hourly instillation of 30 per cent. albucid drops. That seemed extraordinary if they were diluted below effective strength in six minutes. He had been impressed by Mr. Ridley's advocacy of an oil-in-water emulsion as a vehicle for the administration of atropine. What strength atropine did Mr. Ridley employ for routine work in children?

Mr. Goldsmith said the lecturer had mentioned lysozyme in egg-white, besides tears, sputum, and saliva. Had egg-white any therapeutic value in drop form? He also asked whether the use of an oil-in-water emulsion might increase the general absorption of the contained atropine, and so the liability to general toxic symptoms?

Miss Lingfield described a case in which a child had developed atropine irritation after atropine had been instilled in a perfectly white eye. As far as she knew the child had never been previously sensitised to atropine.

In reply Mr. Ridley said he was not aware of any vitamin association with the secretion of tears having been described. Xerophthalmia occurs in rats

deprived of vitamin A as had been described by Findlay. He had also observed a great reduction in tears protein in such a case on one occasion. He agreed with Mr. Savin that Mr. Lumley had had excellent results with albucid 30 per cent. applied hourly. He attributed this to the strength used and to the frequent application. He had not wished to imply that albucid was useless but to draw attention to the fact that in the concentrations commonly used and infrequently applied it could have no useful action in view of its rapid dilution and the delay of several hours before it began to act effectively. He himself used 1 per cent. atropine for refraction work and thought that less than this strength was inadequate as a cycloplegic in children. He deprecated the routine use of 1 per cent. atropine in treatment when a less concentration would very often suffice. If only ¼ per cent. atropine were used as a routine the number of cases of irritation would be reduced to about one quarter. If lamellae were used only the allergic group—about 10 per cent. would remain. He drew attention to the fact that a suspected case could be assessed by the simple patch test he had described and the use of an irritating strength of mydriatic avoided.

In reply to Mr. Goldsmith he said that there was no risk of increased toxicity if oil-in-water emulsions were used, the high concentration of the drug in the restricted water phase increased its efficacy but was offset, as regards toxicity, by the small amount of total drug administered. Egg-white drops might be useful, but many patients would develop sensitisation to egg albumen. Also the concentration of lysozyme was not much higher in egg white than in normal tears, one should concentrate on the restoration of a normal titre in the tears. He said there was no case reported in which irritation had developed to a first drop of atropine and theoretically it should be impossible. He had not seen irritation develop in the routine use of atropine for refraction in children.

ABSTRACTS

MISCELLANEOUS

(1) **Vail, Derrick and Ascher, K. W. (Cincinnati).—Corneal vascularisation problems.** *Amer. Jl. of Ophthal.*, p. 1025, October, 1943.

(1) In a comprehensive paper the authors show that as long as definite pathological corneal processes are absent corneal vascularization never takes place and even very intensive engorgement does not suffice for trespassing upon the anatomically preformed limbal meshwork. Any kind of long-standing engorgement in conjunctival vessels may open up pre-existing narrower vessels or collaterals, but neovascularization of the normally clear cornea does not occur in the absence of corneal disease or involvement in disease.

A. F. MacCallan.

(2) **Haycraft, G. F. (Wolverhampton).—Amblyopia ex anopsia.** Middlemore Lecture, 1943.

(2) **Haycraft** gave the Middlemore Lecture in 1943 with the above title, with special reference to recruitment for the Armed

Forces. It is a valuable contribution to an important subject. As regards visual acuity he adopted vision of 6/24 or worse as his standard of amblyopia; his orthoptic trainer suggested 6/12, but all will agree with the author that 6/12 is not bad sight and much too high a standard of amblyopia. "*Of 760 men referred from* National Service Medical Boards 219 came within this standard of amblyopia in one or other eye. Of these 82 showed some definite lesion to account for it." A table showing this group is of interest as showing the incidence of ocular disability in young healthy men drawn from a large manufacturing area. Myopic fundus changes headed the list with corneal opacities a close second. Traumatic cataract and retinal detachment came next. There were 6 cases of anophthalmos after injury, and only 4 cases of malingering.

His amblyopia ex anopsia cases numbered 137 and he divides them into squinters and non-squinters. Besides these, 12 cases of squint were not amblyopic by his standard, all had refractive errors but only two wore glasses. Details of these 12 cases are given in tabular form.

The non-squinting amblyopes numbered 63 and the percentage of anisometropia was very high.

The author next deals with amblyopia among children attending the Wolverhampton Eye Infirmary. Of 117 cases seen during the last few years 22 per cent. had amblyopic eyes. "One encouraging fact in comparing these children with the grown-up squinting recruits—the majority of whom gave no history of treatment—is that these untreated adults showed amblyopia in 86 per cent."

"Whoever first coined the phase 'a lazy eye' did a great disservice to the squinting child." . . . "Who is to stimulate the lazy oculist?"

The author enters a strong plea for admitting children with amblyopia ex anopsia to hospital as soon as the squint is discovered. "One would never hesitate to admit to hospital a patient threatened with blindness from acute glaucoma or a perforating injury of the globe. It is surely wise to look upon the commencement of a squint as an emergency which, if neglected, will end in partial or even complete blindness of an eye."

R. R. J.

(3) **Rosenthal, Charles M. and Guzek, Joseph T. (Brooklyn).—Thrombosis of central retinal vein treated successfully with heparin. Report of two cases.** *Arch. of Ophthal.*, Vol. XXX, p. 232, 1943.

(3) Two cases of treatment with heparin are carefully and fully described in this paper, cases in which a most satisfactory result ensued both in the visual acuity of the affected eyes and in the return to normality of their fundi.

Both occurred at an earlier age than is usual, namely, 39 and 35, and in both general medical examination was negative except for a septic tonsil in one case, and except for shortened coagulation time, which was one minute in one case, and one-and-half minutes in the other.

In both cases treatment was not started until symptoms had been present for 5 and 3 weeks respectively; it was continued for 10 days in one case and for 5 days in the other.

These reports seem convincing and complete, and will encourage further therapy. The reviewer, on account of recent work in this country on the same subject (*Trans. Ophthal. Soc. U.K.*, Vol. LXII, p. 123, 1942), thinks it necessary to issue a warning against undue optimism. Results without treatment are sometimes brilliant especially in relatively young persons, in whom the obstruction may not have been complete; in some of these the picture is probably a periphlebitis rather than a true thrombosis. Results in seven cases treated with heparin were disappointing in six. Attention must also be drawn to certain dangers during the administration of the drug, namely, haemorrhage and toxic reaction.

F. A. JULER.

(4) **Rosengren, B. and Stenström, S.—Thirty cases of retinal venous thrombosis, treated with heparin. (30 Fälle von venen Thrombose der Netzhaut, behandelt mit Heparin).** *Acta Ophthal.*, Vol. XX, 2, p. 145, 1942.

(4) **Rosengren** and **Stenström** report the treatment of 10 cases of central venous thrombosis and 20 cases of branch venous thrombosis of the retina with heparin. The dosage was in most cases 125 mgm. of the drug intravenously twice daily for 10 days. There was some improvement in 21 cases at first but at a later date further failure occurred in some of these.

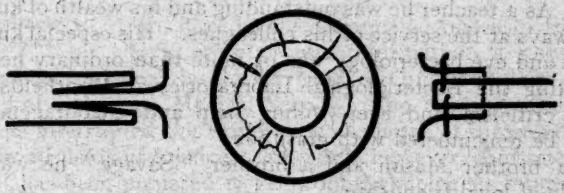
The reviewer in studying the figures in relation to the 10 central vein cases notes that improvement occurred in only one of these; in that case the improvement was from 0·02 to 0·30 of the normal. He believes that the results of branch thrombosis without any treatment are so variable that the effect of heparin is impossible of control, in the absence of a number of cases in which a normal circulation is re-established.

F. A. JULER.

CORRESPONDENCE

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—It appears to me that the result of the usual operation of advancement and recession for strabismus must leave an eye with a mechanically imperfect mechanism for co-ordination except when looking forward in the horizontal plane, and that the insertions of the muscles should remain in their natural positions. I therefore split the tendon and muscle in the muscle that is too short into three strands and sever the upper and lower strands near the insertion leaving the middle strand inserted. The further this splitting is carried back the more stretching is to be expected. The opposite muscle (usually the external) I free backwards for an appropriate distance, sever in front of a clamp, then insert a fine eyeless needle armed with catgut through the insertion of the



tendon from within outwards, including the upper third of the tendon. The needle is then brought through the other segment of the cut tendon from within outwards behind the clamp including the upper third of the tendon.

The same procedure is repeated with the lower third of the cut tendon and the sutures then tied and cut short. I close the conjunctival wound over the shortened tendon with a purse-string suture. This is unnecessary over the lengthened tendon. The advantages of this procedure are:—

(1) It is possible to have a motor mechanism of the eye perfect in any position and not only in the horizontal plane.

(2) It is not necessary to insert stitches into the sclera, some in the region of the ciliary body.

I include a rough diagram of the condition.

Yours truly,

J. W. KILLEN.

LONDONDERRY,
February 22, 1944.

OBITUARY

PROFESSOR J. W. H. EYRE

PROFESSOR JOHN EYRE attained such commanding rank as a bacteriologist that it is sometimes forgotten that his first interests were in ophthalmology. After qualification from Guy's Hospital in 1893 he became ophthalmic assistant to Brailey and Higgens and it was at this period of his life that he published the results of his work in the bacteriology of the eye, in which he was one of the pioneers, in a series of papers that became classical. His researches were chiefly confined to the bacteriology of the normal conjunctival sac and to conjunctival tuberculosis. He died on February 17, 1944, at the age of 74 years.

Mr. S. H. Browning writes:—

It can be the good fortune of few to have had as a teacher and friend, a man of the genius, personality and charm of Prof. John Eyre. As a teacher he was outstanding and his wealth of knowledge was always at the service of his colleagues. His especial knowledge of eyes and eye bacteriology was of more than ordinary help to me in starting the Bacteriological Laboratories at Moorfields and his kindly criticism and ever willing help and encouragement will always be remembered with gratitude.

As a brother Mason and a brother "Savage" he was a true example of loyal friendship.

NOTES

Princess Tsahai Memorial Hospital Fund

WE have received a letter appealing for funds to found in Ethiopia a hospital with Medical School, library and ambulance services in memory of Princess Tsahai as a token of goodwill from Great Britain to Ethiopia. Princess Tsahai qualified in Nursing at Guy's Hospital and returned to her home to organize a modern medical and nursing service in her own country. Her death, at the age of 22 years, occurred on August 17, 1942.

The appeal has the warm support of the heads of the medical and nursing professions in this country and it goes without saying that British ophthalmology records its sympathy. There must be a great opportunity for preventative ophthalmology in Ethiopia and we wish the appeal to be successful. Further information can be obtained from the Hon. Secretary, Miss E. Sylvia Pankhurst, 3 Charteris Road, Woodford, Essex.

Prevention of Blindness Bengal

THE thirteenth annual report of the Association for the Prevention of Blindness, Bengal, 1942-43, has just reached us. It follows closely the lines of previous annual reports and we are glad to note that in spite of war conditions there has been progress in the association's work and activities. Five travelling eye dispensaries are now in action. Research has been carried on and work for the rehabilitation of the blind has been initiated. Here of course the prevention of blindness is of paramount importance. Legislation is still needed to control the activities of the Native couchers, but a lead has been given by the Government of the Central Provinces and Berar, and it is to be hoped that at no distant date the other great Indian states will follow suit.

Propaganda work was maintained during the year to which this report belongs; lectures were given, posters, films and magic lantern slides were used.

Short reports on the working of the travelling eye dispensaries are given among the appendices and there is the annual financial statement.

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Ophthalmology Newsletter

WE have received from the American Library, U.S. office of war information, a newsletter which has been prepared by the Division of Ophthalmology of the University of California Medical School. The heading notes that the war has interrupted the world-wide exchange of information on progress in all fields of science. Research, however, continues, and this leaflet has been prepared to keep ophthalmologists informed of recent work. The contents are abstracts of five papers in various American ophthalmological publications and include papers on intra-ocular injection of sulphanilamide in a case of purulent iridocyclitis, on non-surgical aspects of ocular injuries, on combined intra-cranial and orbital operation for retinoblastoma, on penicillin and sulphadiazine in the treatment of experimental intra-ocular infection with the pneumococcus, and on ocular myasis. It has been arranged to bring out a similar communication once a month. The idea is an excellent one and we wish it all success.

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Oxford Ophthalmological Congress, 30th Annual Meeting, 1944

THIS year's meeting of the Oxford Congress has been arranged for July 6 and 7 at the Department of Human Anatomy, Oxford.

A discussion on injuries to the eyeball (excluding foreign bodies) will be opened by Alex. MacRae and Charles Rudd. The Doyne Memorial lecture will be delivered by Professor Geoffrey Jefferson. The annual dinner will be held at Somerville College, where is accommodation for between 80 and 90 persons. Arrangements have been made for accommodation at Holywell Manor and at 13 Norham Gardens.

On July 7, members have been invited to tea by the Chairman of the Oxford Eye Hospital. The attendance fee is two guineas and further information can be obtained from Dr. F. A. Anderson, 12, St. John's Hill, Shrewsbury.

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Ophthalmological Society of Egypt

THE Annual Congress was held at the Memorial Ophthalmic Laboratory, Giza, on March 15-16, 1944. A symposium on ulcers of the cornea was the chief item of discussion.

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Ophthalmological Research at Oxford

THE University of Oxford is appealing for funds to create a Department of Ophthalmological Research in order in the first place to equip and maintain laboratories, lecture rooms and a library in connexion with the Oxford Eye Hospital. In the second place to provide salaries for full-time and part-time research workers, teachers and technicians, and in the third place to defray working costs of research directed to the prevention of blindness, the improved treatment of eye disease, and the promotion of higher standards of visual function throughout the country. A very strong committee has been formed under the chairmanship of the Vice-Chancellor, the Provost of Oriel, which includes the names of Sir Walter Citrine; Sir Stewart Duke-Elder; Mr. W. McG. Eagar, of the National Institute for the Blind; the Regius Professor of Medicine; Sir William Goodenough; Professor Liddell, F.R.S.; Miss Ida Mann; the Lord Mayor of London; Sir John Parsons, F.R.S.; Mr. T. H. Tylor, of the National Institute for the Blind; Sir John Forbes Watson; the President of Trinity; Mr. A. P. Young; with Mrs. de Boisse, as Secretary.

The Lord Mayor of London gave a luncheon on February 22, at the Mansion House to inaugurate the appeal. It was attended by representatives of Industry as well as by members of the Committee. The Vice-Chancellor, Sir David Ross, gave an address. We are sure that this appeal will have the whole-hearted support and the good will of all ophthalmologists.

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Special Notice

WE are asked by the Ministry of Information to state that the fact that goods made of raw materials in short supply owing to war conditions are advertised in this journal should not be taken as an indication that they are necessarily available for export.